

"Chloral" to "Indigo," not only gives descriptions of all important chemical elements and compounds contained between these two heads, but contains short articles on matters of general chemical interest, both of theory and of practice. The editors desire to give their work a truly international character, and we find valuable contributions, not only from eminent English specialists, but from equally competent authorities in Washington, Baltimore, and Sydney; whilst the presence of articles from the pen of a lady—Miss Ida Freund, of Newnham—indicates that scientific research and exposition are no longer to be confined to the hands and heads of the so-called stronger sex.

In turning over the eight hundred pages of this closely but clearly printed volume, one is first struck by the enormous mass of detail with which the editors have had to deal. Not what to print, but what to leave out, is the problem which all writers whose hard fate it is to have to record the present condition of chemical science have to try to solve. So enormous is the number of chemical substances which each day brings forth, so complicated are the questions of theory which their existence raises—questions which therefore vary from day to day and from month to month—that to give a clear and yet complete account of them may indeed be said to "pass the wit of man." Still, this, like other difficult problems, has to be attempted, and upon the way in which the attempt is made depends the success or failure of a work of this kind. Unless the student can gain a clear and correct idea of the present condition of the science as regards the special subject of the article upon which he seeks information, the book is worse than useless. Unless the specialist can find at least some sort of light and leading, and is supplied with references for detail to the work done by his fore-runners, the "Dictionary" will be of but poor service to him. I venture, however, to think that, tried by both these standards, the verdict of the public will be that the editors have acquitted themselves well, and that this second quarter of the new chemical "Dictionary" will rank as high as the first already does, and will bear favourable comparison with the older parent volume—now, alas, with its author, numbered with those whose names have for us only an historic interest.

A dictionary merely confined to an enumeration of the names, composition, properties, and constitution of the many thousands of chemical compounds now known, like the classical work of Beilstein—however valuable, nay essential, to the student in the higher terms of the series—is not what the beginner or the general scientific reader or worker needs. He must have access to a book in which both the general and the special problems of the science are discussed with full knowledge of the position of the day. That this necessity has been understood, and carefully provided for, is seen by the list of articles furnished by special contributors, as well as by glancing at those written by the editors themselves. In that on "Chemical Classification," by Mr. Muir, we find an able statement of the case, with the modest introduction that "in the following article nothing more is attempted than to sketch the outlines of the methods by the employment of which a fairly satisfactory scheme of chemical classification may be attained," followed by the well-known

definition of scientific classification given by Jevons in his "Principles of Science." The article on "Crystallization," by Mr. Harry Baker, is a model of perspicuity, and, whilst much shorter than the article on the same subject in the former edition, is sufficiently comprehensive for those who wish to gain a knowledge of the principles of this important branch.

Of all the special articles, perhaps that by Prof. J. J. Thomson, of Cambridge, on "Chemical Equilibrium," and that on "Dissociation," by Prof. Threlfall, of Sydney, are the most interesting and important. Both of these articles seem to give a new tone to ordinary chemical life; they introduce the chemist to fresh fields and pastures new. They point to the fact that the stream dividing chemistry from physics has been bridged over, not only at one point but at many, and that certain chemical phenomena which beforetime have been considered as apart and distinct can now be shown to be capable of mathematical treatment, as belonging to the domain of molecular physics.

Whilst, however, in certain directions chemistry is rapidly becoming a branch of physics, there are other chemical phenomena which ally themselves with those classed as biological, and of the most important of these the "Dictionary" gives us an example in an excellent though too short article on "Fermentation and Putrefaction," by Dr. Rideal. Prof. Ira Remsen, of Baltimore, contributes two articles, one on "Equivalency" and one on "Formulae." In this latter he reminds us of a fact known to but few that the symbolic notation introduced by Dalton in 1808 had been preceded by an attempt, though a less satisfactory one, in the same direction by Hassengrätz and Adel in 1787, though we may be sure that of this attempt the Manchester philosopher was in blissful ignorance.

Other special articles, such as those on "Combustion and Flame," by Prof. Thorpe, on "Dextrin," by Mr. O'Sullivan, on "Cinchona Bark," by Mr. David Howard, amongst many others, have only to be mentioned to show the value and interest of the volume, which (in spite of necessary shortcomings, and of occasional unavoidable errors, which some may care to seek for, though I do not) appears to me to be well worthy of the name it bears, of the house which publishes it, and of the science which it expounds, and this is saying a great deal.

H. F. ROSCOE.

OUR BOOK SHELF.

Index of Spectra. By (W. Marshall Watts, D.Sc., &c. Revised Edition. Manchester: Abel Heywood and Son, 1889.)

DR. WATTS is to be congratulated upon the completion of his great undertaking—namely, to collect all the existing measurements of laboratory spectra, and arrange them in a manner convenient for reference. Since the last edition of the book was published, seventeen years ago, spectroscopic research has made enormous progress, as a comparison with the new edition will show. This is no doubt partly due to the increased number of workers, and instrumental advances, and to a large extent to the

extension of the spectroscopic field into the ultra-violet and infra-red. In the old tables the limits of the spectra were practically 394 and 670, whereas in the new ones the lines range from 204 to 770. Spectroscopy has also advanced in another direction. It was formerly believed that each substance had its own characteristic spectrum, from which there was no departure; but subsequent researches have shown that the spectrum does not entirely depend upon the substance under examination, but also upon the conditions of temperature and pressure. In the old tables, for example, only one spectrum of oxygen was recorded, but now no less than three are given. Hydrogen, again, has now two spectra recorded, and nitrogen three, including Hasselberg's important observations.

The wave-lengths given in Ångström's "Spectre Normal du Soleil," with a few small corrections, are still taken as the standards for reduction. The tables printed in the Reports of the British Association Committee form the basis of the new edition, but there are also many important additions. One new feature is the addition of a column giving oscillation frequencies, in number of waves per centimetre *in vacuo*, which will no doubt be appreciated most by investigators of the molecular origin of spectra. Tables of the spectra of various compounds, such as ammonia, alumina, and other oxides, chlorides, iodides, &c., and water, are also given. The different substances are arranged alphabetically as in the old edition, and at the head of each there are full references to books and memoirs. The introductory matter has also been considerably expanded, and now forms an excellent guide to spectroscopic scales and methods of mapping. The use of a lens to throw an image of the light source on to the slit, a method which has yielded many valuable results, is, however, unfortunately omitted. The book will be heartily welcomed by all who are engaged in spectroscopic work, and no recommendation of ours is necessary.

A Text-book on Steam and Steam-Engines. By Prof. Andrew Jamieson, M.Inst.C.E. (London: Chas. Griffin and Co., 1889.)

WE welcome with pleasure the fifth edition of this work. Few engineering text-books are intelligible to the average student. Many writers, in dealing with even the simplest engine or mechanical contrivance, completely fog the reader's understanding by the undue use of mathematics and abstruse formulæ. The volume before us is the best yet published for use in the engineering classes at our schools and colleges. Prof. Jamieson has treated the subject in a sensible and useful manner; his examples are worked out as simply as possible; and the descriptions throughout the work are those of a practical man who knows his business.

The new edition contains many extensive and important additions both to the text and illustrations. The chapter on locomotives has been considerably enlarged and improved. An express-engine built by Messrs. Dubs and Co., the eminent Glasgow locomotive builders, is taken as an example, and many well-executed scale-drawings are given as illustrations. Even with these additions the chapter does not do justice to this important branch of engineering, and Prof. Jamieson must not overlook the fact that he has many locomotive engineer apprentices attending his Glasgow classes. The few paragraphs on the compound locomotive are decidedly weak. Mr. Webb's compound locomotive "The Experiment" is excellent ancient history, no doubt; but why not describe the more recent Webb compounds, or, better still, the Worsdell and Von Borries two-cylinder compounds, now doing such good work on the North-Eastern and many foreign railways?

N. J. L.

LETTERS TO THE EDITOR.

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An Unusual Geological Sequence.

IN a late expedition to the north-west coast I have come upon evidence of a fact which was quite new to me—namely, that the well-known Cambrian red sandstones of Ross and Sutherland do not always rest upon the Archæan gneiss, but occasionally on dark blue stratified rocks with which the sandstones are perfectly conformable. For many years I have been familiar with the ordinary sequence, according to which the Cambrian or "Torridon" sandstones rest unconformably on the Archæan gneiss with nothing interposed between them. Nowhere in Sutherland, or in Loch Torridon, so far as I have observed, is there any variation in this order, and I have stood on some hills in Sutherland where the Cambrian sandstones are represented by only a few remaining cakes of conglomerate which lie bedded almost horizontally upon highly unconformable gneissic strata. I was therefore much surprised to see in a little creek on the eastern shore of the Island of Rāasay, a low precipice of the red sandstone terminating in conformable beds of a rock of very dark colour, and with a texture but little crystalline. The sudden and violent change of colour at once attracted my attention, and on landing and obtaining specimens I found there could be no mistake that the Cambrian sandstones here rest upon some older rock totally different in mineral character from the Archæan gneiss, and equally different from themselves.

Pursuing this (to me) discovery, I examined the eastern face of the same island, where its precipices include fine escarpments both of the Secondary and of the older rocks. There, at one point, I found the same unusual sequence beautifully distinct. The sandstones are represented by a bed of strong conglomerate, and this bed rests conformably upon well stratified rocks of a blue, or dark blackish-blue colour, with a fracture far less crystalline than most of our Silurian slates on the mainland of Argyllshire.

Following up the same clue, I found that on the western shores of the Island of Scalpa, these blue rocks underlie in great thickness the red sandstones which form the bulk of the island, and which are exclusively seen by all who approach it from the eastern and northern sides.

I now understand that this fact has been for some time known to Dr. Geikie, and that the officers of the Survey under him have come across it with equal surprise, in certain parts of Ross-shire. But, so far as I know, it has not been published, and is not generally known.

In one specimen which I obtained on Scalpa there are obscure indications of Annelid borings, together with calcareous cavities, which are very suggestive of an organic origin.

If these rocks really belong to the Cambrian series, as this complete conformability would imply, and if they have been wholly removed in all but a few spots, before the Torridon sandstones were laid down, the fact gives one a good deal to think of both as regards the intervals of time which they represent, and as regards the agencies of change which must have been at work.

To what horizon do these blue rocks belong? The Sutherland fossils from Durness are thought to be among the very oldest Silurian forms. Below these come the great white quartzites of the same county. Below them, again, unconformably, come the Torridon sandstones, and lowest of all come these subsequent blue beds—not at all metamorphosed—less crystalline than many of the secondary rocks. Yet they must be amongst the very oldest sedimentary rocks known to us.

I may add that I found by actual experiment that in a deposit now forming here, of the same blue colour, Annelid burrows develop precisely the same ferruginous stains which I find in the Scalpa specimen before referred to.

ARGYLL.

Inveraray, Argyllshire.

Mr. Galton on Natural Inheritance.

MR. GALTON'S recent ingenious book on natural inheritance suggests some remarks on the value of his method and results. In the first place, it is plain that the method of probable error, which he uses, is only applicable with any certainty to cases